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**SYSTEM AND METHOD FOR FILTERING
DATA RECEIVED BY A COMPUTER SYSTEM**

BACKGROUND OF THE INVENTION

1. Field Of The Invention

The present invention relates to a computer based system and method for filtering data received by a computer system and, in particular, to a computer based system and method for filtering text data from World Wide Web pages received by a computer system connected to the Internet.

2. Prior Art

While there are numerous benefits which accrue from the interconnection of computers or computer systems in a network, such an interconnection presents certain problems as well.

Broadly speaking, networks allow the various computers connected to the network to share information. Typically, if desired, access to certain information is restricted by providing access codes or the like to those individuals who are cleared to view or download the information. While this method of controlling access to information works fairly well for situations where each user is identifiable, it is very difficult to efficiently and effectively implement such a method in cases where there is a large number of unidentifiable users. Such is the situation with the vast interconnection of networks called the Internet.

The Internet is accessed by many millions of users every day and while it is somewhat possible to obtain some

information with respect to identifying the computers through which a particular user accesses the Internet, it very difficult, if not impossible, to identify a particular user beyond any self-identification provided by the user himself.

5 By far, most of the traffic on the Internet currently occurs on the World Wide Web. On the World Wide Web, both text and graphic information is typically provided on web pages and this information is transmitted via the Hyper Text Transfer Protocol ("HTTP"). A web page has a particular address associated with it called a Uniform Resource Locator ("URL").

10 A typical user accesses the World Wide Web via a modem connection to a proxy/cache server which is connected to the Internet. A browser is the software program which runs on the user's computer (client computer) and allows the user to view web pages. To view a particular web page, the user inputs the URL of the desired web page into his or her browser. The browser sends the request to the proxy/cache server and the server sends the request over the Internet to the computer on which the web page resides. A header as well as a copy of the body of the web page is then sent back to the user's browser and displayed on the user's computer.

20 While an incredible amount of information is available on the millions of web pages provided on the World Wide Web, some of this information is not appropriate for all users. In particular, although children can be exposed to a vast number

of educational and entertaining web pages, many other web pages include adult content which is not appropriate for access by children.

One method which is used to control access to these adult web pages is to require an access code to view or download particular web pages. Typically, this access code is obtained by providing some identification, often in the form of a credit card number. The obvious drawbacks of this method are: 1) such a system will invariably deny or inhibit access to many adults as well as children because many adults do not want to, or may not be able to, provide a credit card number; and 2) the system is not fool-proof because children may obtain access to credit cards, whether their's or their parents'.

Several services are available to parents and educators which provide a second method for preventing access to web pages containing adult content. These services provide software programs which contain a list of forbidden URLs. Service providers compile the list by searching the World Wide Web for web pages having objectionable material. When a user inputs a URL which appears on the forbidden list or "deny list," the program causes a message to be displayed indicating that access to that web page is forbidden. Although this method works well for denying access to web pages which are on the forbidden list, because thousands of web pages are being created and changed every day, it is simply impossible to

provide an up-to-date list of every web page containing adult content. Therefore, these systems often allow children access to web pages which contain adult content but have not yet been added to the forbidden list.

5 A further drawback to the above-described access control systems is that they are simple admit/deny systems. That is, the user is either allowed to download and view the entire web page or he/she is forbidden from doing so. It is not practical, using either of these methods, to allow a particular user to download and view only the portions of the web page which are not objectionable.

SUMMARY OF THE INVENTION

15 The present invention overcomes the disadvantages of the prior art by providing a system and method for restricting access to objectionable or "target" data received by a computer over a network by filtering objectionable data from the data received. The present invention provides for filtering the data as received, so called "on the fly," so that a newly created web page may be filtered as accurately as one that has been predetermined to contain objectionable material.

20 Although the embodiments of the invention are described below with respect to a system and method for filtering objectionable data from the data received, it should be understood that the present invention can be applied to

process any type of target data from the data received. Thus, the present invention may be utilized to process desired data such that, for instance, only Web pages containing desired information are displayed on the user's computer.

5 In a preferred embodiment, the present invention provides a computer based method for filtering text data from World Wide Web pages which are received by a computer system connected to the Internet. Advantageously, the method of the present invention is carried out by the computer which acts as
10 the proxy/server through which the user's computer is connected to the Internet. However, the method can be carried out by the user's computer as well.

15 According to the method, if the web page requested by the user contains only a minimum of objectionable or target data, the user receives a portion of the filtered web page for downloading and viewing on his or her computer. While, if the web page requested contains a large amount of objectionable material, the invention will cause a "forbidden" page to be displayed on the user's computer monitor.

20 In the preferred embodiment, the request is sequentially filtered at three different levels, if necessary. First, the URL requested is filtered to determine if the web page associated with that URL has been pre-approved or pre-denied. If the URL has not be pre-approved or pre-denied, the header
25 of the web page is then filtered to determine if the web page contains text data (such as HTML). If so, the body of the web

page is filtered. While the filter will decide whether or not to block access to the entire web page based on the URL, depending on its processing of the body of the web page, the filter may deny access completely to the web page, deny access to certain portions of the web page (i.e., filter out some objectionable words), or allow complete access to the web page.

The method of the present invention first compares the requested URL to an "allow list" which contains URLs of web pages which have been approved for display to the user. If the requested URL is found in the allow list, the entire associated web page is, accordingly, forwarded to the user for downloading or viewing. If, however, the requested URL is not found in the allow list, the requested URL is then compared to a "deny list," (or "forbidden list") which functions in much the same manner as that of the prior art systems. If the requested URL is found in the forbidden list, a message is transmitted to the user's computer indicating that access to the web page is forbidden (hereinafter referred to as a "FORBIDDEN" page).

If the requested URL is found in neither the allow list or the deny list, and if the header indicates that the page contains text data, then the method provides for filtering the text of the web page, as it is either received from the network or read out of cache, to determine if it contains objectionable or target text. If the page contains

objectionable text, the method determines what kind of objectionable text (specific words), how much objectionable text, and the relative groupings of objectionable text. Depending on the settings of predetermined parameters, certain objectionable words (if found) are either replaced with an innocuous filler (such as "---") before the web page is forwarded to the user's computer, or only a "FORBIDDEN" page is forwarded to the user's computer. The settings of the predetermined parameters may be modified by those having access to the computer program through which the computer implements the program, such as the server operator or, perhaps, the user's parent.

Optionally, the HTTP header of the web page is filtered after the URL to determine if the page contains text data and, if not, the method does not filter the web page body, since the method for filtering the web page body is only capable of filtering text or other recognizable data patterns. The method provides for filtering the text of the web page by comparing each "word" (defined by groupings of letter/number characters) in the web page to a "dictionary." The words in the dictionary are periodically updated.

Advantageously, each word in the dictionary has a number of variables associated with it, such as: 1) a variable that indicates whether the word, if found, should be replaced with the innocuous filler (or a specific replacement filler word may be indicated); 2) a variable that indicates what category

of objectionableness the word belongs to (i.e., pornography, intolerance, crime, job hunting, etc.); 3) a variable that indicates what language the word is a part of (i.e., english, french, spanish, etc.); 4) a base score variable that indicates how objectionable the word is; and 5) a bonus score variable that indicates whether the word is more objectionable when used in combination with other objectionable words. In this advantageous embodiment, the method provides for filtering the body of the web page by comparing each word in the web page with the words in the dictionary. If a word in the web page matches, then that word will either be replaced or not replaced with the filler, as indicated by the variable. A running score is determined for the entire web page, based on a particular algorithm, as the page is being filtered. If the final score for the page is above a predetermined threshold score, a "FORBIDDEN" page is forwarded to the user's computer instead.

The system of the present invention comprises a general purpose computer which is programmed to implement the method of the present invention. The computer of such a system is typically the proxy/cache server computer but it may also be the client computer or another computer.

While the preferred embodiment of the present invention is described in summary form above as applied to the filtering of web pages received over the Internet, it will be appreciated by one of ordinary skill in the art that this

method is also applicable to filtering of data received by a computer from any network, including an intranet. Further, in addition to reviewing HTTP information received from the Internet, the present invention may be applied to review information posted to forms-based pages such as search engines, surveys, guest books, etc. (POST/GET data). If the words or phrases would yield objectionable results, the invention will prevent posting of the data to the remote HTTP server.

Other objects, features, and advantages of the present invention will be set forth in, or will become apparent from, the detailed description of the preferred embodiments of the invention which follows.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a block diagram of a preferred embodiment of the system of the present invention.

Figure 2 is a flowchart showing the broad steps of filtering a web page URL, header, and body in accordance with one embodiment of the method of the present invention.

Figure 3 is a flowchart showing the steps for filtering a URL request in accordance with the embodiment of **Figure 2**.

Figure 4 is a flowchart showing the steps for filtering a web page header in accordance with the embodiment of **Figure 2**.

Figure 5 is a flowchart showing the steps for filtering a web page body in accordance with the embodiment of **Figure 2**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

5 **Figure 1** shows a block diagram of a preferred embodiment of the system of the present invention. In this embodiment, a proxy/cache server computer **110** is connected to the Internet and is capable of receiving HTTP information over the World Wide Web. A client computer **120** (user's computer) is connected to the server computer **110**, typically via an ethernet or modem connection. In accordance with the present invention, server computer **110** runs a computer program **112** which programs the server computer **110** to filter any request it receives for a web page from the client computer **120** and to output to the client computer **120** only those web pages, or portions of web pages, which are deemed appropriate for viewing by the user of the client computer **120**. This filtering takes place in at least three stages, as is described below relative to Figures 2 through 5, which illustrate the method of the present invention.

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25 Advantageously, the proxy/cache server **110** used in the system of the present invention is a SPARC workstation made by Sun Microsystems, Inc. and the server **110** is programmed to filter the requests in the Perl programming language. The inventors of the present invention have determined that a SPARC workstation programmed in accordance with the method set forth below, is capable of filtering at least approximately 90KB to 500KB of data per second, based on the speed of the CPU.

The flowchart in **Figure 2** shows the broad steps of filtering a requested web page URL, header, and body in accordance with one embodiment of the method of the present invention. The method begins at terminal block **210** and continues to block **212** where the user selected URL is input. The URL request is filtered at decision block **214** and the filter decision is "yes" if the request is denied based on the URL and "no" if the request is not denied at this point. If decision block **214** returns a "yes," block **216** shows that a page indicating access is forbidden ("FORBIDDEN" page) is to be returned, which page will be output to the client computer. If decision block **214** returns a "no," the HTTP header is input at block **218** and filtered at decision block **220**. If decision block **220** returns a "yes," block **222** shows that the "FORBIDDEN" page is to be returned and if decision block **220** returns a "no," the first portion of the body of the web page is input at block **224**.

Decision block **226** checks to see if the end of the page has been reached and, if so, the method returns to await another user selected URL. If the end of the page has not been reached, that portion of the body of the web page is filtered at decision block **228**. If decision block **228** returns a "yes" (objectionable material found), then that portion of the web page is modified and, if certain rules are met, it is later sent to the client computer, indicated at block **232**. If decision block **228** returns a "no," indicating no objectionable

material was found in that portion of the web page body, then control is returned to block **224** where the next portion of the web page body is input.

The filters indicated in decision blocks **214**, **220**, and **228** are shown in the flowcharts of **Figures 3**, **4**, and **5**, respectively. The filters shown in **Figures 3** and **5** are based on a method involving a dictionary, which dictionary can be updated periodically, and a score threshold for indicating whether or not a web page should be forbidden.

Each word or phrase in the dictionary has several variables associated with it. Together each word in the dictionary and its associated variables form an entry in the dictionary. In a preferred embodiment, each entry in the dictionary has the following format:

Target:Replace:Category:Language:BaseScore:BonusScore
where "Target" is the objectionable or target word. "Replace" indicates whether or not the word or phrase should be replaced in the text if it is found (R = replace, N = not replace). "Category" is the category the word belongs to (e.g., pornography, intolerance, crime, violence, etc.), and "Language" is the language the word belongs to (e.g., english, french, spanish, etc.). "BaseScore" is the score the word contributes to the total score of the web page body, or portion thereof, if it is found and "BonusScore" is the additional score the word contributes to the total score if it is found in close proximity to other objectionable words. A

word may be assigned a negative score, which would subtract from the total score instead of adding to it.

In the preferred embodiment, the default threshold score at which a web page will be forbidden is 50, although this score can readily be changed by anyone having the required access.

Examples of possible words and associated variables in the dictionary are as follows.

nude:N:pornography:english:5:5

This entry would be for the word "nude." "Nude," if found would not be replaced in the text (N); it is in the pornography category; it is in the english language; it has a score of 5; and it contributes a bonus score of 5 if found with other words in the dictionary.

hot:N:none:english:0:5

This entry, for the word "hot," is not to be replaced if found; is in no particular category; is in the english language; has no score; and has a bonus score of 5.

The flowchart of **Figure 3** shows the portion of the method which is represented by decision block **214** in **Figure 2**, showing filtering of the URL request. This portion of the method begins at terminal block **310** and in block **312** a variable called "filter" is turned on and a variable called "score" is set to zero. The "filter" variable is used to later indicate whether the header or body of the web page should be filtered (on) or not filtered (off). "Score" is the

the request. Decision block **326** checks to see if the last word in the request has already been filtered and, if so, decision block

328 determines whether the "Score" of the request at this point is greater than the predetermined threshold "Targetscore," which threshold may, advantageously, be changed by one having the appropriate access. If the "Score" variable is not greater than the "Targetscore" threshold, then terminal block **332** returns a "No," indicating that the page should not be forbidden. If the "Score" variable is greater than the "Targetscore" threshold, then terminal block **330** returns a "Yes," indicating the page should be forbidden. If decision block **326** indicates that the last word in the request has not already been filtered, then decision block **334** compares "Word" against the dictionary. If "Word" does not match an entry in the dictionary, then "Word" is set to the next word in the request and decision block **326** again checks to see if the last word has been filtered. If "Word" does match an entry in the dictionary, then decision block **338** determines whether "Word" has content, that is, is the category variable not set to "none" or, alternatively is the category variable set to a particular category of interest (for instance, "pornography"). If "Word" does not have content (category = none), then, in block **340**, "Word" is again set to the next word in the request and, if "Word" does have content (category ≠ "none" or category = a particular category), "Score" is set

to the previous value of "Score" plus the base score of the word and "Word" is then set to the next word in the request. Control returns to decision block **326**.

5 The filtering method for the header of the web page, indicated at decision block **220** of **Figure 2**, is shown in detail in **Figure 4**. This method essentially determines if the page is in text (such as HTML) such that it may be effectively reviewed by the filter.

10 The method begins at terminal block **410** and decision block **412** determines whether the "Filter" variable is set to "On." If the "Filter" variable is not set to "On," indicating that the header should not be filtered, then terminal block **414** returns a "No." If the "Filter" variable is set to "On," then decision block **416** determines whether the page contains text data and, if so, the "Score" variable is set to zero and the "Found" variable is set to Null at block **418**, and terminal block **420** returns a "No," indicating the page should not be forbidden based on the header. If decision block **416** determines that the page does not contain text data, then the
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20 "Filter" variable is set to "Off" in block **422** and terminal block **424** returns a "No."

25 The filtering method for the body of the web page, uses the dictionary and the variables described above, however this method introduces new variables as well which enable it to consider the proximity of the objectionable words to each other, as well as other factors, in deciding whether or not to

If the total score for the page exceeds the predetermined threshold, e.g., 50, then the entire page is replaced with a "FORBIDDEN" page. In an advantageous embodiment, only words in the same language are scored together and separate thresholds are predetermined for each category.

Optionally, the "FORBIDDEN" page provides additional information, such as the total score for the page, the score of the page in each category, the language of the objectionable words in the page, etc. This information may be viewed and the thresholds may be changed by one having the appropriate access, for instance, a parent or teacher.

The examples below illustrate how the scoring of a "Chain" is accomplished.

Sample Dictionary

hot:N:none:english:0:5
fantasy:N:none:english:0:5
pictures:N:none:english:0:5
nude:N:pornography:english:5:5
sexual:N:pornography:english:5:5
harassment:N:none:english:0:-10

Sample "Chain"

Score

sexual fantasy	15	(sexual has content and multiple words from the dictionary are in the "Chain" so bonus scores count. 5+5 from "sexual" and 5 from "fantasy")
sexual harassment	0	(sexual has content and

			multiple words are in the "Chain", so bonus scores count. 5+5 from "sexual" and -10 from "harassment")
5			
	pictures	0	("pictures" has no content)
10	hot pictures	0	(neither "hot" or "pictures" has content)
	nude	5	("nude" has content, but only one word in "Chain", so only the base score applies)
15			
	hot nude pictures	20	(3 words in "Chain", 1 with content, all base and bonus scores apply)
20			

One embodiment of the filtering method for the body of the web page, indicated at decision block **228** of **Figure 2**, is shown in detail in **Figure 5**. This method uses a "Proximity" variable to indicate whether a word found to be in the dictionary is within two words of the last word found to be in the dictionary, such that it should be part of the same "Chain." Also, a "Found" list is used to keep track of all the objectionable words found which should be replaced if the web page is to be displayed. Additionally, a "Tempchain" variable allows the method to determine if the next two sequential words are actually in the dictionary before they are added to the "Chain."

The method is begun at terminal block **510** and decision block **512** determines whether the "Filter" variable is set to "On." If not (indicating that the body of the web page should

not be filtered), terminal block **514** returns a "No." If "Filter" is "On," then "Word" is set to the first word in the page at block **516**. Decision block **518** determines whether the last word in the page has already been filtered and, if it has, block **520** indicates that all the words in the "Found" list are replaced with the replace word (e.g., "----"). Decision block **522** determines whether the "Score" for the page exceeds the predetermined "Targetscore" threshold and, if so, the page is replaced with the "FORBIDDEN" page in block **526** before a "Yes" is returned by terminal block **528**, indicating that access was denied based on the web page body. If the score does not exceed the "Targetscore" threshold, a "No" is returned at terminal block **524**.

If decision block **518** determines that the last word in the page has not been filtered, then decision block **530** is invoked to determine if "Word" is in the dictionary. If so, "Tempchain" is added to "Chain" along with "Word" and the "Proximity" variable is set to 1, in block **532**. Block **534** then sets "Word" to the next word on the page. If "Word" is not in the dictionary, then decision block **536** checks to see if "Chain" is null (i.e., contains no words) and, if it is, block **534** sets "Word" to the next word on the page. If "Chain" is not null, decision block **538** determines if "Proximity" is greater than zero. If "Proximity" is greater than zero, indicating that the last word was in the dictionary, then 1 is subtracted from "Proximity" and "Word"

is added to "Tempchain" in block 540. Block 534 then sets "Word" to the next word on the page. If "Proximity" is not greater than zero, then this indicates that the last two words were not in the dictionary and thus, the "Chain" is ended. The next portion of the method scores the "Chain."

In block 542, "Word" is set to the first word in the "Chain." If that is not the last word in the "Chain," as determined in decision block 544, then decision block 546 determines whether "Word" is replaceable. If yes, then "Word" is added to the "Found" list in block 550 and control is sent to block 548. If "Word" is not replaceable, then control is sent directly to block 548. Block 548 sets: "Base Score" to the previous "Base Score" plus the "Word's" base score; "Bonus Score" to the previous "Bonus Score" plus the "Word's" bonus score; "Content" to "Yes" if the "Word" has content; and "Word" to the next word in the "Chain". Block 544 then again determines if the "Word" is the last word in the "Chain".

If "Word" is the last word in the "Chain", then decision block 552 determines if "Content" is set to "yes." If so, then block 554 sets "Score" to the previous "Score" plus the "Bonus Score" and "Base Score," as last determined in block 548. Control is then sent to block 556. If "Content" is not set to "yes," then block 556 sets: "Chain" to null; "Tempchain" to null; "Proximity" to zero; "Bonus Score" to zero, "Base Score" to zero; and "Content" to "No." Block 534 then sets "Word" to the next word on the page.

One of ordinary skill in the art will recognize that the methods shown in the flowcharts of **Figures 2** through **5** can readily be programmed into a computer using any of several computer programming languages. Advantageously, the method shown in **Figure 2** serves as the main loop of the program and the methods shown in **Figures 3** through **5** serve as subroutines. The normal attendant initialization of variables, error checking, and the like, is programmed as required.

As noted above, while the system and method of the invention have been described with relation to filtering objectionable data from data received, the method can also be used to process data such that only Web pages containing desired data are passed to the user's computer.

Although the invention has been described in detail with respect to preferred embodiments thereof, it will be apparent to those skilled in the art that variations and modifications can be effected in these embodiments without departing from the spirit and scope of the invention.